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B.W.LFE

B. W. Lee

Customer No.:

07278

PATENT TRADEMARK OFFICE

Docket No.: 9373/1G811US1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Frances H. ARNOLD, et al.

Serial No.: 09/722,602 Art Unit: TBA

Confirmation No.: 5781

Filed: November 27, 2000 Examiner: TBA

For: DIRECTED EVOLUTION OF OXIDASE ENZYMES

STATEMENT PURSUANT TO RULE 1.821(f)

June 18, 2001

Hon. Commissioner for Patents and Trademarks Washington, DC 20231

Sir:

Enclosed herewith is a computer readable form (diskette) and a paper copy containing a sequence listing for the above-referenced matter.

The contents of the attached paper entitled "SEQUENCE LISTING" and of the accompanying identically labeled diskette, specifically the ASCII-encoded file therein labeled "Seqlist.txt", are identical.

This sequence submission contains no new matter.

Consideration of the enclosed diskette and paper are respectfully requested.

Respectfully submitted,

Paul F. Fehlner, Ph.D.

Reg. No. 31,135

Agent for Applicants

DARBY & DARBY, P.C. 805 Third Avenue New York, N.Y. 10022 Phone (212) 527-7700



SEQUENCE LISTING

<110> ARNOLD, Frances H.
 PETROUNIA, Ionna P.
 SUN, Lianhong

<120> DIRECTED EVOLUTION OF OXIDASE ENZYMES

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<140> US 09/722,602

<141> 2000-11-27

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Pro	210					215				Val	220				
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			420					425					430	}	Ser
		435)				440	ŀ				445	1		Pro
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                                105
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Tyr Ser Asn Phe Glu Thr Arg Pro Ala Arg Tyr Val Arg Leu Val Ala
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Ile Thr Glu Ala Asn Gly Gln Pro Trp Thr Ser Ile Ala Glu Ile Asn
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<213> Dactylium dendroides

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Pro	Ser 210	Thr	Gly	Ile	Val	Ser 215	Asp	Arg	Thr	Val	Thr 220	Val	Thr	Lys	His
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Gln Ser Ser 305	Ser Trp 290 Ser	Ser 275 Ser Lys	260 Ala Gly Thr	Ile Thr Gly Trp	Met Val Thr 310	Ser Phe 295 Ser	Asp 280 Glu Leu	265 Gly Lys Pro	Met Arg Asn Asn	Val Gly Ala 315	Phe Glu 300 Lys	Thr 285 Val Val	270 Ile Tyr Asn	Gly Gly Ser Pro	Gly Pro Met 320
Gln Ser Ser 305 Leu	Ser Trp 290 Ser Thr	Ser 275 Ser Lys Ala	260 Ala Gly Thr Asp	Thr Gly Trp Lys 325	Met Val Thr 310 Gln	Ser Phe 295 Ser Gly	Asp 280 Glu Leu Leu	265 Gly Lys Pro	Met Arg Asn Asn Arg 330	Val Gly Ala 315 Ser	Phe Glu 300 Lys Asp	Thr 285 Val Val Asn	270 Ile Tyr Asn His	Gly Gly Ser Pro Ala 335	Gly Pro Met 320 Trp
Gln Ser Ser 305 Leu	Ser Trp 290 Ser Thr	Ser 275 Ser Lys Ala	260 Ala Gly Thr Asp	Thr Gly Trp Lys 325	Met Val Thr 310 Gln	Ser Phe 295 Ser Gly	Asp 280 Glu Leu Leu	265 Gly Lys Pro	Met Arg Asn Asn Arg 330	Val Gly Ala 315 Ser	Phe Glu 300 Lys Asp	Thr 285 Val Val	270 Ile Tyr Asn His	Gly Gly Ser Pro Ala 335	Gly Pro Met 320 Trp
Gln Ser Ser 305 Leu Leu Ala	Ser Trp 290 Ser Thr Phe Met	Ser 275 Ser Lys Ala Gly Asn 355	260 Ala Gly Thr Asp Trp 340 Trp	Thr Gly Trp Lys 325 Lys Tyr	Met Val Thr 310 Gln Lys Tyr	Ser Phe 295 Ser Gly Gly Thr	Asp 280 Glu Leu Leu Ser Ser 360	265 Gly Lys Pro Tyr Val 345 Gly	Met Arg Asn Asn Arg 330 Phe Ser	Val Gly Ala 315 Ser Gln Gly	Phe Glu 300 Lys Asp Ala Asp	Thr 285 Val Val Asn Gly Val 365	270 Ile Tyr Asn His Pro 350 Lys	Gly Gly Ser Pro Ala 335 Ser Ser	Gly Pro Met 320 Trp Thr Ala
Gln Ser Ser 305 Leu Leu Ala	Ser Trp 290 Ser Thr Phe Met	Ser 275 Ser Lys Ala Gly Asn 355	260 Ala Gly Thr Asp Trp 340 Trp	Thr Gly Trp Lys 325 Lys Tyr	Met Val Thr 310 Gln Lys Tyr	Ser Phe 295 Ser Gly Gly Thr	Asp 280 Glu Leu Leu Ser Ser 360	265 Gly Lys Pro Tyr Val 345 Gly	Met Arg Asn Asn Arg 330 Phe Ser	Val Gly Ala 315 Ser Gln Gly	Phe Glu 300 Lys Asp Ala Asp	Thr 285 Val Val Asn Gly Val	270 Ile Tyr Asn His Pro 350 Lys	Gly Gly Ser Pro Ala 335 Ser Ser	Gly Pro Met 320 Trp Thr Ala
Gln Ser Ser 305 Leu Leu Ala Gly Asn 385	Ser Trp 290 Ser Thr Phe Met Lys 370 Ala	Ser 275 Ser Lys Ala Gly Asn 355 Arg	260 Ala Gly Thr Asp Trp 340 Trp Gln Met	Thr Gly Trp Lys 325 Lys Tyr Ser Tyr	Met Val Thr 310 Gln Lys Tyr Asn Asp 390	Ser Phe 295 Ser Gly Gly Thr Arg 375 Ala	Asp 280 Glu Leu Leu Ser 360 Gly Val	265 Gly Lys Pro Tyr Val 345 Gly Val Lys	Met Arg Asn Asn Arg 330 Phe Ser Ala Gly	Val Gly Ala 315 Ser Gln Gly Pro Lys 395	Phe Glu 300 Lys Asp Ala Asp Asp 380 Ile	Thr 285 Val Val Asn Gly Val 365 Ala Leu	270 Ile Tyr Asn His Pro 350 Lys Met	Gly Gly Ser Pro Ala 335 Ser Ser Cys Phe	Gly Pro Met 320 Trp Thr Ala Gly Gly 400
Gln Ser Ser 305 Leu Leu Ala Gly Asn 385 Gly	Ser Trp 290 Ser Thr Phe Met Lys 370 Ala Ser	Ser 275 Ser Lys Ala Gly Asn 355 Arg Val	260 Ala Gly Thr Asp Trp 340 Trp Gln Met Asp	Thr Gly Trp Lys 325 Lys Tyr Ser Tyr Tyr 405	Met Val Thr 310 Gln Lys Tyr Asn Asp 390 Gln	Ser Phe 295 Ser Gly Gly Thr Arg 375 Ala Asp	Asp 280 Glu Leu Leu Ser 360 Gly Val Ser	265 Gly Lys Pro Tyr Val 345 Gly Val Lys Asp	Met Arg Asn Asn Arg 330 Phe Ser Ala Gly Ala 410	Val Gly Ala 315 Ser Gln Gly Pro Lys 395 Thr	Phe Glu 300 Lys Asp Ala Asp Asp 380 Ile Thr	Thr 285 Val Val Asn Gly Val 365 Ala	270 Ile Tyr Asn His Pro 350 Lys Met Thr Ala	Gly Ser Pro Ala 335 Ser Cys Phe His 415	Gly Pro Met 320 Trp Thr Ala Gly Gly 400 Ile

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Asn Gly Leu Tyr Phe Ala Arg Thr Phe His Thr Ser Val Val Leu Pro
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Asp Gly Ser Thr Phe Ile Thr Gly Gly Gln Arg Arg Gly Ile Pro Phe
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Glu Asp Ser Thr Pro Val Phe Thr Pro Glu Ile Tyr Val Pro Glu Gln
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Asp Thr Phe Tyr Lys Gln Asn Pro Asn Ser Ile Val Arg Ala Tyr His
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Ser Ile Ser Leu Leu Pro Asp Gly Arg Val Phe Asn Gly Gly
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Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe
                                                 525
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Thr Pro Asn Tyr Leu Tyr Asp Ser Asn Gly Asn Leu Ala Thr Arg Pro
                                             540
                        535
Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile
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                    550
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr
                                     570
                565
Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu
                                 585
            580
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser
                                                 605
                             600
Asp Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn
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                        615
Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln
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                     630
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      <212> PRT
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Gly Asn Lys Asp Thr Phe Trp His Thr Phe Tyr Gly Ala Asn Gly Asp
                                                 45
                             40
Pro Lys Pro Pro His Thr Tyr Thr Ile Asp Met Lys Thr Thr Gln Asn
                         55
Val Asn Gly Leu Ser Val Leu Pro Arg Gln Asp Gly Asn Gln Asn Gly
                     70
Trp Ile Gly Arg His Glu Val Tyr Leu Ser Ser Asp Gly Thr Asn Trp
                                     90
                 85
 Gly Ser Pro Val Ala Ser Gly Ser Trp Phe Ala Asp Ser Thr Thr Lys
                                 105
```

Tyr Ser Asn Phe Glu Thr Arg Pro Ala Arg Tyr Val Arg Leu Val Ala

		115					120					125			
Ile	Thr		Ala	Asn	Glv	Gln		Trp	Thr	Ser	Ile		Glu	Ile	Asn
	130				4	135		1-			140				
	Phe	Gln	Ala	Ser		Tyr	Thr	Ala	Pro		Pro	Gly	Leu	Gly	_
145	Clv	Dro	Thr	Tla	150	Tau	Dro	Tlo	Wal.	155 Pro	7.1.5	7.1.5	7.] _	ת ות	160
ттр	Оту	110	1111	165	voh	пеα	110	116	170		Ата	міа	ALA	175	116
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
7 0 7 -	D1	0 3	180	~	ъ.	01	<i>0.</i> 7	185	m)	-	m l	~	190	Prof.	3 0
Ala	Pne	195	Gly	Ser	Pro	GLY	200	TTE	Thr	Leu	Thr	Ser 205	Ser	Trp	Asp
Pro	Ser		Gly	Ile	Val	Ser		Arq	Thr	Val	Thr		Thr	Lys	His
	210		4			215	_	ر			220			_	
_	Met	Phe	Cys	Pro	-	Ile	Ser	Met	Asp	_	Asn	Gly	Gln	Ile	
225 Val	Thr	Glv	Gly	Zan	230	Δla	T.170	T.v.e	Thr	235	T. 211	Пυν	Zen	Sar	240 Sar
Val	T11T	OLY	СТУ	245	дор	лта	БУЗ	цуз	250	Der	пси	туг	изр	255	OCI
Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	-	Met	Gln	Val	Ala	_	Gly	Tyr
~1	0	0	260	m1	3.4 - ±	Q	73	265	70	*7 - 7	D1	m1	270	0.1	G3
GIN	ser	5er 275	Ala	Thr	мет	ser	280	GTÀ	Arg	val	Pne	285	TTE	СΤΆ	СТА
Ser	Trp		Gly	Gly	Val	Phe		Lys	Asn	Gly	Glu		Tyr	Ser	Pro
	290		_	_		295		_		_	300				
Ser 305	Ser	Lys	Thr	Trp	Thr 310	Ser	Leu	Pro	Asn	Ala 315	Lys	Val	Asn	Pro	Met 320
	Thr	Ala	Asp	Lvs		Glv	Len	Tvr	Ara		Asp	Asn	His	Ala	
	~		-10 P	325	0211	017	200	- 1 -	330	001	110 P	11011		335	1-1
Leu	Phe	Gly	Trp	Lys	Lys	Gly	Ser		Phe	Gln	Ala	Gly		Ser	Thr
717	Mot	Nan	340 Trp	Titan	m. t.r.c.	Thr	Sor	345	Sor	C1	7\ c.r.	Wa 1	350	Sar	71.7
AIa	ne c	355	тър	тут	тĀТ	7117	360	GTĀ	Set	СТУ	Asp	365	гуу	ser	Ala
Gly			Gln	Ser	Asn			Val	Ala	Pro			Met	Cys	Gly
7	370	77-7	M - +	m	7)	375	77 - 7	T	C1	T	380	т	m1	Dl	C1
4sn 385	Ala	vaı	Met	Tyr	390			_	GLY	ьуs 395	TTE	Leu	Tnr	Pne	Gly 400
	Ser	Pro	Asp	Tyr			Ser		Ala		Thr	Asn	Ala	His	Ile
				405					410					415	
Ile	Thr	Leu		Glu	Pro	Gly	Thr		Pro	Asn	Thr	Val		Ala	Ser
Asn	Glv	Leu	420 Tyr	Phe	Ala	Ara	Thr	425 Phe	His	Thr	Ser	Va1	430 Val	ī.eu	Pro
	1	435	- 1 -			5	440					445	,	200	
Asp	_	Ser	Thr	Phe	Ile		Gly	Gly	Gln	Arg	_	Gly	Ile	Pro	Phe
Gla	450	Sar	Thr	Dro	V = 1	455 Pho	Thr	Dro	Gl II	Tlo	460	V > 1	Dro	Glu	Gln
465	2131	DUL	T11T	110	470	LIIG	7117	LIO	JIU	475	тут	Val	110	oru	480
	Thr	Phe	Tyr	-	Gln	Asn	Pro	Asn		Ile	Val	Arg	Ala		
00.5	T 7 a	Com	T 0::	485	Т ~	Dan	7) ~~~	C1	490	77 7	Dh -	7\ ~	C1	495	C1
ser	тте	ser	теп	теп	ьеи	PLO	ASP	стλ	arg	val	rne	ASN	GTÀ	$\alpha \tau \lambda$	Gly

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500
                                 505
                                                     510
Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe
                            520
                                                 525
Thr Pro Asn Tyr Leu Tyr Asn Ser Asn Gly Asn Leu Ala Thr Arg Pro
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Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile
                    550
                                         555
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr
                565
                                     570
Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu
                                 585
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser
                                                 605
        595
                            600
Asp Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn
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Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln
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      <211> 639
      <212> PRT
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<213> Dactylium dendroides

<400> 17

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Gly Asn Lys Asp Thr Phe Trp His Thr Phe Tyr Gly Ala Asn Gly Asp
                            40
Pro Lys Pro Pro His Thr Tyr Thr Ile Asp Met Lys Thr Thr Gln Asn
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Val Asn Gly Leu Ser Val Leu Pro Arg Gln Asp Gly Asn Gln Asn Gly
Trp Ile Gly Arg His Glu Val Tyr Leu Ser Ser Asp Gly Thr Asn Trp
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Gly Ser Pro Val Ala Ser Gly Ser Trp Phe Ala Asp Ser Thr Thr Lys
                                105
Tyr Ser Asn Phe Glu Thr Arg Pro Ala Arg Tyr Val Arg Leu Val Ala
                                                125
                            120
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Ile Thr Glu Ala Asn Gly Gln Pro Trp Thr Ser Ile Ala Glu Ile Asn
                        135
Val Phe Gln Ala Ser Ser Tyr Thr Ala Pro Gln Pro Gly Leu Gly Arg
                    150
                                        155
Trp Gly Pro Thr Ile Asp Leu Pro Ile Val Pro Ala Ala Ala Ile
                165
                                    170
Glu Pro Thr Ser Gly Arg Val Leu Met Trp Ser Ser Tyr Arg Asn Asp
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                                185
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Ala Phe Glu Gly Ser Pro Gly Gly Ile Thr Leu Thr Ser Ser Trp Asp
        195
                            200
Pro Ser Thr Gly Ile Val Ser Asp Arg Thr Val Thr Val Thr Lys His
                                            220
                        215
Asp Met Phe Cys Pro Gly Ile Ser Met Asp Gly Asn Gly Gln Ile Val
                    230
                                        235
Val Thr Gly Gly Asn Asp Ala Lys Lys Thr Ser Leu Tyr Asp Ser Ser
                                    250
                245
Ser Asp Ser Trp Ile Pro Gly Pro Asp Met Gln Val Ala Arg Gly Tyr
                                265
            260
Gln Ser Ser Ala Thr Met Ser Asp Gly Arg Val Phe Thr Ile Gly Gly
                            280
Ser Trp Ser Gly Gly Val Phe Glu Lys Asn Gly Glu Val Tyr Ser Pro
                                            300
                        295
Ser Ser Lys Thr Trp Thr Ser Leu Pro Asn Ala Lys Val Asn Pro Met
                    310
                                        315
Leu Thr Ala Asp Lys Gln Gly Leu Tyr Arg Ser Asp Asn His Ala Trp
                325
                                    330
Leu Phe Gly Trp Lys Lys Gly Ser Val Phe Gln Ala Gly Pro Ser Thr
                                345
            340
Ala Met Asn Trp Tyr Tyr Thr Ser Gly Ser Gly Asp Val Lys Ser Ala
                            360
                                                 365
Gly Lys Arg Gln Ser Asn Arg Gly Val Ala Pro Asp Ala Met Cys Gly
                        375
                                            380
Asn Ala Val Met Tyr Asp Ala Val Lys Gly Lys Ile Leu Thr Phe Gly
                                        395
                    390
Gly Ser Pro Asp Tyr Gln Asp Ser Asp Ala Thr Thr Asn Ala His Ile
                405
                                    410
Ile Thr Leu Gly Glu Pro Gly Thr Ser Pro Asn Thr Val Phe Ala Ser
                                425
                                                     430
Asn Gly Leu Tyr Phe Ala Arg Thr Phe His Thr Ser Val Val Leu Pro
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                            440
                                                 445
Asp Gly Ser Thr Phe Ile Thr Gly Gly Gln Arg Arg Gly Ile Pro Phe
                        455
                                            460
Glu Asp Ser Thr Pro Val Phe Thr Pro Glu Ile Tyr Val Pro Glu Gln
                    470
                                        475
Asp Thr Phe Tyr Lys Gln Asn Pro Asn Ser Ile Val Arg Ala Tyr His
                485
                                    490
Ser Ile Ser Leu Leu Pro Asp Gly Arg Val Phe Asn Gly Gly
                                505
                                                     510
Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe
        515
                                                 525
                            520
Thr Pro Asn Tyr Leu Tyr Asp Ser Asn Gly Asn Leu Ala Thr Arg Pro
                        535
Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile
                    550
                                        555
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr
                                    570
                565
                                                         575
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Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu
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                                585
                                                     590
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser
                            600
Asp Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn
                                            620
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Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln
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      <210> 18
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      <213> Dactylium dendroides
      <400> 18
Ala Ser Ala Pro Ile Gly Ser Ala Ile Ser Arg Asn Asn Trp Ala Val
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Gly Asn Lys Asp Thr Phe Trp His Thr Phe Tyr Gly Ala Asn Gly Asp
                            40
Pro Lys Pro Pro His Thr Tyr Thr Ile Asp Met Lys Thr Thr Gln Asn
                        55
Val Asn Gly Leu Ser Met Leu Pro Arg Gln Asp Gly Asn Gln Asn Gly
                    70
Trp Ile Gly Arg His Glu Val Tyr Leu Ser Ser Asp Gly Thr Asn Trp
Gly Ser Pro Val Ala Ser Gly Ser Trp Phe Ala Asp Ser Thr Thr Lys
                                105
                                                     110
Tyr Ser Asn Phe Glu Thr Arg Pro Ala Arg Tyr Val Arg Leu Val Ala
                            120
                                                125
Ile Thr Glu Ala Asn Gly Gln Pro Trp Thr Ser Ile Ala Glu Ile Asn
```

Trp Gly Pro Thr Ile Asp Leu Pro Ile Val Pro Ala Ala Ala Ile 170 165 Glu Pro Thr Ser Gly Arg Val Leu Met Trp Ser Ser Tyr Arg Asn Asp 185 Ala Phe Gly Gly Ser Pro Gly Gly Ile Thr Leu Thr Ser Ser Trp Asp 200 205 Pro Ser Thr Gly Ile Val Ser Asp Arg Thr Val Thr Val Thr Lys His 215 220 Asp Met Phe Cys Pro Gly Ile Ser Met Asp Gly Asn Gly Gln Ile Val 230 235 Val Thr Gly Gly Asn Asp Ala Lys Lys Thr Ser Leu Tyr Asp Ser Ser 250 245

Val Phe Gln Ala Ser Ser Tyr Thr Ala Pro Gln Pro Gly Leu Gly Arg

155

135

150

Ser Asp Ser Trp Ile Pro Gly Pro Asp Met Gln Val Ala Arg Gly Tyr

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265
            260
Gln Ser Ser Ala Thr Met Ser Asp Gly Arg Val Phe Thr Ile Gly Gly
                            280
                                                285
        275
Ser Trp Ser Gly Gly Val Phe Glu Lys Asn Gly Glu Val Tyr Ser Pro
                        295
                                            300
Ser Ser Lys Thr Trp Thr Ser Leu Pro Asn Ala Lys Val Asn Pro Met
                    310
                                        315
Leu Thr Ala Asp Lys Gln Gly Leu Tyr Arg Ser Asp Asn His Ala Trp
                                    330
                325
Leu Phe Gly Trp Lys Lys Gly Ser Val Phe Gln Ala Gly Pro Ser Thr
                                345
            340
Ala Met Asn Trp Tyr Tyr Thr Ser Gly Ser Gly Asp Val Lys Ser Ala
                            360
                                                365
Gly Lys Arg Gln Ser Asn Arg Gly Val Ala Pro Asp Ala Met Cys Gly
                        375
Asn Ala Val Met Tyr Asp Ala Val Lys Gly Lys Ile Leu Thr Phe Gly
                                        395
                    390
Gly Ser Pro Asp Tyr Gln Asp Ser Asp Ala Thr Thr Asp Ala His Ile
                405
                                    410
Ile Thr Leu Gly Glu Pro Gly Thr Ser Pro Asn Thr Val Phe Ala Ser
            420
                                425
Asn Gly Leu Tyr Phe Ala Arg Thr Phe His Thr Ser Val Val Leu Pro
                            440
Asp Gly Ser Thr Phe Ile Thr Gly Gly Gln Arg Arg Gly Ile Pro Phe
                        455
                                            460
Glu Asp Ser Thr Pro Val Phe Thr Pro Glu Ile Tyr Val Pro Glu Gln
                    470
                                        475
Asp Thr Phe Tyr Lys Gln Asn Pro Asn Ser Ile Val Arg Val Tyr His
                                    490
                485
Ser Ile Ser Leu Leu Pro Asp Gly Arg Val Phe Asn Gly Gly Gly
                                505
Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe
                            520
                                                 525
        515
Thr Pro Asn Tyr Leu Tyr Asn Ser Asn Gly Asn Leu Ala Thr Arg Pro
                        535
                                            540
Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile
                                        555
                    550
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr
                                    570
                565
Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu
                                585
            580
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser
                            600
                                                 605
Asp Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn
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                                            620
Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln
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<210> 19
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<213> Dactylium dendroides
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Gly Ser Pro Val Ala Ser Gly Ser Trp Phe Ala Asp Ser Thr Thr Lys 135 140 Val Phe Gln Ala Ser Ser Tyr Thr Ala Pro Gln Pro Gly Leu Gly Arg 150 155 160 Trp Gly Pro Thr Ile Asp Leu Pro Ile Val Pro Ala Ala Ala Ile 165 170 Glu Pro Thr Ser Gly Arg Val Leu Met Trp Ser Ser Tyr Arg Asn Asp 185 Ala Phe Gly Gly Ser Pro Gly Gly Ile Thr Leu Thr Ser Ser Trp Asp 195 200 Pro Ser Thr Gly Ile Val Ser Asp Arg Thr Val Thr Val Thr Lys His 215 220 Asp Met Phe Cys Pro Gly Ile Ser Met Asp Gly Asn Gly Gln Ile Val 230 235 Val Thr Gly Gly Asn Asp Ala Lys Lys Thr Ser Leu Tyr Asp Ser Ser 245 250 Ser Asp Ser Trp Ile Pro Gly Pro Asp Met Gln Val Ala Arg Gly Tyr 265 Gln Ser Ser Ala Thr Met Ser Asp Gly Arg Val Phe Thr Ile Gly Gly 280 Ser Trp Ser Gly Gly Val Phe Glu Lys Asn Gly Glu Val Tyr Ser Pro 295 300 Ser Ser Lys Thr Trp Thr Ser Leu Pro Asn Ala Lys Val Asn Pro Met 310 315 Leu Thr Ala Asp Lys Gln Gly Leu Tyr Arg Ser Asp Asn His Ala Trp 325 330 335

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Leu Phe Gly Trp Lys Lys Gly Ser Val Phe Gln Ala Gly Pro Ser Thr
            340
                                345
                                                     350
Ala Met Asn Trp Tyr Tyr Thr Ser Gly Ser Gly Asp Val Lys Ser Ala
        355
                            360
                                                 365
Gly Lys Arg Gln Ser Asn Arg Gly Val Ala Pro Asp Ala Met Cys Gly
                        375
Asn Ala Val Met Tyr Asp Ala Val Lys Gly Lys Ile Leu Thr Phe Gly
                    390
                                         395
Gly Ser Pro Asp Tyr Gln Asp Ser Asp Ala Thr Thr Asp Ala His Ile
                405
                                     410
Ile Thr Leu Gly Glu Pro Gly Thr Ser Pro Asn Thr Val Phe Ala Ser
                                425
                                                     430
            420
Asn Gly Leu Tyr Phe Ala Arg Thr Phe His Thr Ser Val Val Leu Pro
        435
                            440
                                                 445
Asp Gly Ser Thr Phe Ile Thr Gly Gly Gln Arg Arg Gly Ile Pro Phe
                        455
                                             460
Glu Asp Ser Thr Pro Val Phe Thr Pro Glu Ile Tyr Val Pro Glu Gln
                    470
                                         475
Asp Thr Phe Tyr Lys Gln Asn Pro Asn Ser Ile Val Arg Val Tyr His
                485
                                     490
Ser Ile Ser Leu Leu Pro Asp Gly Arg Val Phe Asn Gly Gly Gly
                                505
            500
Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe
        515
                            520
                                                 525
Thr Pro Asn Tyr Leu Tyr Asn Ser Asn Gly Asn Leu Ala Thr Arg Pro
                        535
                                             540
Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile
                    550
                                         555
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr
                565
                                    570
Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu
            580
                                585
                                                     590
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser
        595
                            600
                                                 605
Asp Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn
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Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln
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<210> 20

<211> 639

<212> PRT

<213> Dactylium dendroides

<400> 20

Ala Ser Ala Pro Ile Gly Ser Ala Ile Ser Arg Asn Asn Trp Ala Val 1 5 10 15 Thr Cys Asp Ser Ala Gln Ser Gly Asn Glu Cys Asn Lys Ala Ile Asp

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Gly	Asn	Lys 35	Asp	Thr	Phe	Trp	His 40	Thr	Phe	Tyr	Gly	Ala 45	Asn	Gly	Asp
Pro	Lys 50	Pro	Pro	His	Thr	Tyr 55	Thr	Ile	Asp	Met	Lys 60	Thr	Thr	Gln	Asn
Val 65	Asn	Gly	Leu	Ser	Met 70	Leu	Pro	Arg	Gln	Asp 75	Gly	Asn	Gln	Asn	Gly 80
Trp	Ile	Gly	Arg	His 85	Glu	Val	Tyr	Leu	Ser 90	Ser	Asp	Gly	Thr	Asn 95	Trp
Gly	Ser	Pro	Val 100	Ala	Ser	Gly	Ser	Trp 105	Phe	Ala	Asp	Ser	Thr 110	Thr	Lys
Tyr	Ser	Asn 115	Phe	Glu	Thr	Arg	Pro 120	Ala	Arg	Tyr	Val	Arg 125	Leu	Val	Ala
Ile	Thr 130	Glu	Ala	Asn	Gly	Gln 135	Pro	Trp	Thr	Ser	Ile 140	Ala	Glu	Ile	Asn
Val 145	Phe	Gln	Ala	Ser	Ser 150	Tyr	Thr	Ala	Pro	Gln 155	Pro	Gly	Leu	Gly	Arg 160
Trp	Gly	Pro	Thr	Ile 165	Asp	Leu	Pro	Ile	Val 170	Pro	Ala	Ala	Ala	Ala 175	Ile
	Pro		180	_	_			185	_			_	190		_
	Phe	195	-			-	200					205		_	_
	Ser 210		_			215	_	_			220			_	
225	Met				230				_	235		_			240
	Thr			245					250					255	
	Asp		260					265					270	_	-
	Ser	275					280	_	_			285		_	-
	Trp 290					295		_		_	300		_		
305					310					315					Met 320
	Thr			325					330					335	_
	Phe		340			_		345				_	350		
	Met	355					360	_		_	-	365	_		
	Lys 370					375					380				
385					390					395					Gly 400
Gly	Ser	Pro	Asp	Tyr	Gln	Asp	Ser	Asp	Ala	Thr	Thr	Asp	Ala	His	Ile

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410
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Ile Thr Leu Gly Glu Pro Gly Thr Ser Pro Asn Thr Val Phe Ala Ser
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            420
Asn Gly Leu Tyr Phe Ala Arg Thr Phe His Thr Ser Val Val Leu Pro
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        435
Asp Gly Ser Thr Phe Ile Thr Gly Gly Gln Arg Arg Gly Ile Pro Phe
                        455
Glu Asp Ser Thr Pro Val Phe Thr Pro Glu Ile Tyr Val Pro Glu Gln
                                        475
                    470
Asp Thr Phe Tyr Lys Gln Asn Pro Asn Ser Ile Val Arg Ala Tyr His
                                    490
                485
Ser Ile Ser Leu Leu Pro Asp Gly Arg Val Phe Asn Gly Gly
                                505
                                                     510
Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe
                            520
        515
Thr Pro Asn Tyr Leu Tyr Asn Ser Asn Gly Asn Leu Ala Thr Arg Pro
                        535
Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile
                                        555
                    550
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr
                                    570
                565
Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu
                                585
            580
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser
                                                 605
                            600
        595
Asp Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn
                        615
                                             620
Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln
                                         635
                    630
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      <400> 21
Ala Ser Ala Pro Ile Gly Ser Ala Ile Ser Arg Asn Asn Trp Ala Val
                                     10
Thr Cys Asp Ser Ala Gln Ser Gly Asn Glu Cys Asn Lys Ala Ile Asp
                                 25
Gly Asn Lys Asp Thr Phe Trp His Thr Phe Tyr Gly Ala Asn Gly Asp
                            40
Pro Lys Pro Pro His Thr Tyr Thr Ile Asp Met Lys Thr Thr Gln Asn
                         55
Val Asn Gly Leu Ser Met Leu Pro Arg Gln Asp Gly Asn Gln Asn Gly
                                         75
Trp Ile Gly Arg His Glu Val Tyr Leu Ser Ser Asp Gly Thr Asn Trp
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90

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Gly Ser Pro Val Ala Ser Gly Ser Trp Phe Ala Asp Ser Thr Thr Lys
             100
                                  105
 Tyr Ser Asn Phe Glu Thr Arg Pro Ala Arg Tyr Val Arg Leu Val Ala
                              120
 Ile Thr Glu Ala Asn Gly Gln Pro Trp Thr Ser Ile Ala Glu Ile Asn
                         135
                                              140
 Val Phe Gln Ala Ser Ser Tyr Thr Ala Pro Gln Pro Gly Leu Gly Arg
                     150
                                          155
 Trp Gly Pro Thr Ile Asp Leu Pro Ile Val Pro Ala Ala Ala Ile
                 165
                                     170
 Glu Pro Thr Ser Gly Arg Val Leu Met Trp Ser Ser Tyr Arg Asn Asp
             180
                                 185
 Ala Phe Gly Gly Ser Pro Gly Gly Ile Thr Leu Thr Ser Ser Trp Asp
         195
                             200
 Pro Ser Thr Gly Ile Val Ser Asp Arg Thr Val Thr Lys His
                         215
Asp Met Phe Cys Pro Gly Ile Ser Met Asp Gly Asn Gly Gln Ile Val
                     230
                                         235
Val Thr Gly Gly Asn Asp Ala Lys Lys Thr Ser Leu Tyr Asp Ser Ser
                 245
                                     250
Ser Asp Ser Trp Ile Pro Gly Pro Asp Met Gln Val Ala Arg Gly Tyr
             260
                                 265
Gln Ser Ser Ala Thr Met Ser Asp Gly Arg Val Phe Thr Ile Gly Gly
                             280
Ser Trp Ser Gly Gly Val Phe Glu Lys Asn Gly Glu Val Tyr Ser Pro
                         295
                                             300
Ser Ser Lys Thr Trp Thr Ser Leu Pro Asn Ala Lys Val Asn Pro Met
                     310
                                         315
Leu Thr Ala Asp Lys Gln Gly Leu Tyr Arg Ser Asp Asn His Ala Trp
                325
                                     330
Leu Phe Gly Trp Lys Lys Gly Ser Val Phe Gln Ala Gly Pro Ser Thr
                                 345
Ala Met Asn Trp Tyr Tyr Thr Ser Gly Ser Gly Asp Val Lys Ser Ala
                            360
Gly Lys Arg Gln Ser Asn Arg Gly Val Ala Pro Asp Ala Met Cys Gly
                        375
                                             380
Asn Ala Val Met Tyr Asp Ala Val Lys Gly Lys Ile Leu Thr Phe Gly
                    390
                                        395
Gly Ser Pro Asp Tyr Gln Asp Ser Asp Ala Thr Thr Asp Ala His Ile
                405
                                    410
Ile Thr Leu Gly Glu Pro Gly Thr Ser Pro Asn Thr Val Phe Ala Ser
            420
                                425
Asn Gly Leu Tyr Phe Ala Arg Thr Phe His Thr Ser Val Val Leu Pro
                            440
                                                 445
Asp Gly Ser Thr Phe Ile Thr Gly Gly Gln Arg Arg Gly Ile Pro Phe
                        455
                                            460
Glu Asp Ser Thr Pro Val Phe Thr Pro Glu Ile Tyr Val Pro Glu Gln
465
                    470
                                        475
```

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Asp Thr Phe Tyr Lys Gln Asn Pro Asn Ser Ile Val Arg Ala Tyr His
                 485
                                     490
Ser Ile Ser Leu Leu Pro Asp Gly Arg Val Phe Asn Gly Gly Gly
                                 505
Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe
        515
                             520
                                                 525
Thr Pro Asn Tyr Leu Tyr Asn Ser Asn Gly Asn Leu Ala Thr Arg Pro
                         535
                                             540
Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile
                    550
                                         555
                                                              560
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr
                565
                                     570
Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu
                                 585
                                                      590
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser
                             600
                                                 605
Asp Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn
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                                             620
Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln
625
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      <211> 10
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cttaattaag
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Met Ala Ser Ala Pro Ile Gly Ser Ala
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      <400> 27
atggcctcag cacctatcgg aagcgcc
    27
      <210> 28
      <211> 27
      <212> DNA
      <213> Dactylium dendroides
      <220>
      <221> unsure
      <222> (1)...(27)
      <223> "n" at positions 6, 9, 12, 15, and 21 is either a,
```

```
t, g, or c.
            "n" at position 18 is either a, t, or c.
      <400> 28
atggenteng encenatngg nagegee
      <210> 29
      <211> 14
      <212> DNA
      <213> Artificial Sequence
      <220>
      <223> Vector sequence
      <400> 29
aggaaaagct tatg
    14
      <210> 30
      <211> 15
      <212> DNA
      <213> Artificial Sequence
      <220>
      <223> Vector sequence
      <400> 30
aggaaaaagc ttatg
    15
      <210> 31
      <211> 16
      <212> DNA
      <213> Artificial Sequence
      <220>
      <223> Vector sequence
      <400> 31
aggaaacaag cttatg
    16
       <210> 32
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       <212> DNA
       <213> Artificial Sequence
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<220>
      <223> Vector sequence
      <400> 32
aggaacaaag cttatg
    16
      <210> 33
      <211> 14
      <212> DNA
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      <223> Vector sequence
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aggaaaagct tatg
    14
      <210> 34
      <211> 15
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      <223> Vector sequence
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aggaaaaagc ttatg
    15
      <210> 35
      <211> 16
      <212> DNA
      <213> Artificial Sequence
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aggaaacaag cttatg
     16
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aggaacaaag cttatg
16